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MS. Arctic America: Discoveries of the Searching Expeditions under the command of Captain H. T. Austin, R.N., C.B., and Captain Penny. 1851. Geological Map of Europe, according to the researches of Sir Roderick I. Murchison, K.C.B., and J. Nicol, F.G.S. Constructed by A. K. Johnston. 1856. Map of Ireland, showing the heights by gradations of shade, to accompany the Report of the Land Tenure Commission. 1845. Four sheets of the Government Map of Bavaria, viz., Nos. 85, Traunstein; 92, Auerberg; 93, Reichenhall; 94, Berchtesgaden. The Eastern Alps, a MS., drawn by Mr. Gardner for Sir R. Murchison. Esquisse de l'Herzegovine et du Montenegro. By H. Br. de Beaumont. Corrected by A. Boné. 1861. Karte des nördlichen Ural, on 2 sheets. By the Ural Expedition. 1847-50. Map of Aderbeijan. By N. Khanikoff. 1862. Map of Turkestan, in Russian characters. 1867. Map of Khiva and the surrounding country. By J. Arrowsmith. 1841. A Russian map of Khiva, showing the theatre of war (in Russian characters). By C. Zimmermann. 1840. A map of the republic of New Granada, dedicated to Baron de Humboldt by Col. Joaquin Acosta. 1847. Victoria, western portion; showing the various trial lines surveyed for projected railways from Port Phillip to the Murray River. 4 sheets. 1855. By G. C. Darbyshire, C.E. Comparative Size of the Scales of the Government Surveys of European Countries, shown by squares. Five outline maps relating to the engraving and shading of hills, by the triotinto and medallion process. Island of Teneriffe. By L. de Buch. 1814. A map of the South-Eastern Alps (Austria). By Julius Payer. Presented by A. Petermann. A Map of Tibet, showing the Gold-fields and Sources of the Indus. By a Pundit. Presented by A. Petermann. French charts, 70 sheets, and 16 books of pilotage.

The PRESIDENT observed that the paper about to be read that evening was by Professor A. E. Nordenskiöld, a distinguished man of science who had accompanied all these memorable expeditions to Spitzbergen, and by Fr. W. von Otter, of the Swedish navy. The Swedes, though not a rich nation, were undertaking for the third time an expedition into these arctic regions. It was a great honour to the Swedish nation that they had accomplished so much in exploring the physical geography of Spitzbergen and of the neighbouring seas.

The Papers of the evening were the following:—

1. *Account of the Swedish North-Polar Expedition of 1868, under the command of A. E. NORDENSKIÖLD and FR. W. VON OTTER.*

(EXTRACTS.)

THE study of the natural history of the polar regions has been of late years prosecuted in Sweden with so much interest that, exclu-

sive of the present year's undertaking, no less than three* separate expeditions have been sent out from this country to the arctic seas. When Nordenskiöld last winter again brought forward a proposal for a new expedition, on a different plan, which was to set out in the autumn from the northern coast of Spitzbergen and penetrate farther northward, the means requisite to defray the expenses of the expedition were in a few days raised in the second city of Sweden, Göteborg [Gottenburg], at the instance of the resident governor, Count Ehrensvärd. When, moreover, the Government, in order to assist the undertaking, fitted out and manned the steamship *Sofia*, well adapted for the purpose, strongly built of Swedish iron, and originally intended to carry the mails over the Baltic in winter, the new expedition was enabled to assume a more extensive character and embrace a wider compass than had originally been intended.

Most expeditions of this kind have had for their object to attain as high a degree of north latitude as possible; but a glance at their history will convince us how difficult and uncertain the attainment of this object is, and how frequently an insignificant circumstance has obliged the, in other respects, best planned expeditions to return without any scientific result whatever,—a contingency which there would have been no reason to apprehend if proper care had been taken in the scientific furnishing and manning of the expedition. In order to remove all fear of the new Swedish expedition

* These were the following:—

The Expedition of 1858, fitted out at the expense of Otto Torell. The following gentlemen took part in the undertaking: O. Torell, A. E. Nordenskiöld, A. Qvennerstedt. The Expedition visited the western coast of Spitzbergen, and brought home considerable zoological and geological collections.

The Expedition of 1861, fitted out at the public expense. The gentlemen who took part in the expedition, besides the proposer and chief, O. Torell, were A. von Goës, A. T. Malmgren, F. A. Smitt, G. von Yhlen, zoologists and botanists; B. Lilliehöök and W. Kuglenstjerna, commanders of the vessels; C. W. Blomstrand, C. Chydenius, N. Dunér and A. E. Nordenskiöld for geological and physical investigations. The expedition visited, in both vessels, the western and northern coasts of Spitzbergen, made extensive journeys in boats for the purpose of constructing a topographical and geological map of the group of islands, and of examining the northern part of the triangulation for degree-measuring, which the present President of the Royal Society, General E. Sabine, as early as 1826, proposed to get executed, in these high northern regions, and lastly brought home with them a collection of materials for studying the *fauna*, *flora*, and geology of the islands, probably not surpassed in completeness by any similar collections from districts situated at so great a distance from the centres of civilisation.

The Expedition of 1864, fitted out at the public expense, chiefly for the purpose of continuing the survey for the measurement of the degree. The gentlemen who took part in the undertaking were A. E. Nordenskiöld, chief, N. Dunér and A. J. Malmgren. The expedition visited the southern part of Spitzbergen and Storfjord, completed the survey for the degree-measuring, and brought home rich geological, zoological and botanical collections.

having a result of this kind, it was determined that in this, as in the preceding Swedish arctic expeditions, a continuation, as general as possible, should be made of the researches in natural history commenced by their predecessors. For this purpose the expedition was, by the Royal Academy of Science in Stockholm, provided with a carefully selected and appropriate scientific apparatus,* and was accompanied by as numerous a body of professional scientific men as room and circumstances permitted.

The plan of the journey was, during the summer and early part of the autumn, to pay a visit in the *Sofia* to Beeren Island and Spitzbergen, and carefully examine both the marine and terrestrial fauna of both lands; their flora, both phanerogamous and cryptogamous, as also their geography and geology. It was also intended to make deep soundings, and to take meteorological and magnetical observations, &c. A supply of coal was to have been deposited by a ship, hired for that especial purpose, at some fitting spot on the north-west corner of Spitzbergen, which is accessible till late in the season; which tract the *Sofia* was accordingly to visit during the course of the autumn, and whence some of the scientific men were, in the beginning or middle of September, to return in one of the colliers to Norway. The rest were to endeavour, in the *Sofia*, to make their way farther north, and, if necessary, to pass the winter (circumstances permitting) in some appropriate harbour of the Seven Isles, which form the Old World's most northern archipelago.

The gentlemen who took part in the expedition were:—*Geologist*,—A. E. Nordenskiöld;† *Captain*,—Fr. W. v. Otter, Royal Swedish Navy; *Lieutenant*,—A. L. Palander, Royal Swedish Navy; *Physician*,—C. Nyström; *Natural Philosopher*,—S. Lemström; *Zoologists*,—A. E. Holmgren, A. J. Malmgren, F. A. Smitt; *Botanists*,—Sv. Berggren, Th. M. Fries; *Geologist*,—G. Nauckhoff.

The vessel was manned by fourteen seamen, together with zoological conservator Svensson, and six dredgers, hired in Norway. The ship placed at the disposal of the expedition having been, under the inspection of Captain von Otter, duly fitted out in Carlscrona, and furnished with provisions for something more than a year—or, when account is duly made of the game that in these

* The London Royal Society and the University of Helsingfors contributed to the instrumental apparatus of the expedition.

† The geographical and hydrographical researches were to be performed by Nordenskiöld, von Otter, and Palander. These last—of whom, in consequence of their office, one was almost always on board—also took upon themselves the meteorological observations. Nyström assisted the zoologists, and also directed his attention to the remarkably interesting hygienic features of these regions.

parts one may always reckon upon, for about a year and a half—and touched at Göteborg to take on board the scientific apparatus and the men of science who took part in the undertaking, anchor was weighed on the 7th of July. The 16th-20th Tromsø was visited for the purpose of taking in coal, &c.

On the 22nd the *Sofia* cast anchor in the southern harbour of Beeren Island, where some members of the expedition landed to study the natural phenomena of a place difficult of access on account of the want of a good harbour; while the remainder continued on board the vessel, which cruised in the neighbourhood, and occupied themselves with soundings and with an examination of the local marine fauna.

The expedition left Beeren Island on the 27th of July. Our course was directed to the eastern coast of Spitzbergen, which had not been visited by any of the previous Swedish expeditions; but already at South Cape we met with ice, which, as we approached the Thousand Isles, became more and more abundant, and we were obliged to turn back. After some hesitation as to whether we should wait at South Cape till the water became more free from ice, in order to proceed further eastward, or immediately begin the scientific operations on the west coast of Spitzbergen that entered into the plan of the voyage, we embraced the latter alternative; and it was very fortunate that we did so, for on our return home we learned that the east coast, during the whole summer of 1868, had been rendered completely inaccessible by the ice.

Our course was now directed to Ice-fjord, where the *Sofia* cast anchor on the morning of the 31st of July. We continued a fortnight in the different harbours of that extensive fjord, and penetrated, in our boat-excursions, to the innermost parts of the fjord's northern arm, which had not previously been visited by the Swedish expeditions. During this time all the members of the expedition were busily occupied in scientific researches, and in collecting objects of natural history. The change was, indeed, advantageous, as well for our zoological and botanical as especially for our geological investigations.

The previous Swedish expeditions had pretty fully explored the principal features of the geology of Ice-fjord, and had found it, in consequence of the varying strata on its shores, full of different types both of animal and vegetable remains, and unusually rich in materials illustrative of the geological history of the extreme north.

Innermost in the fjord are found immense, probably Devonian, beds of red clay-slate, and sandstone, which, however, do not here contain petrifications. On them lie strata of limestone, gypsum,

and flint, filled with large coarse-scaled mountain-limestone brachiopoda; then come *Trias* beds, with large nautilus forms and remains of Saurians; after these, *Jura* strata with *Ammonites*; then *Tertiary* strata, in many places rich in plant-impressions, indicating a former temperate climate; and, lastly, scanty remains of *Post-tertiary* strata, with plant-fragments and sub-fossil marine shells, some of which now first occur in living condition in the northern parts of Norway. The preceding Swedish expeditions had brought home specimens from all these strata;* not, however, sufficiently numerous to give a geological representation of the place's former history so complete as the importance of the subject requires. To supply this defect was one of the chief objects of the expedition of 1868; and we succeeded in bringing home unusually rich collections, especially of plant-impressions and trias petrifications, which, when duly studied, will, no doubt, throw much light on the condition of the climate and arrangement of the land of the arctic regions at that remote period.

Spitzbergen, as is generally known, is at present frequently visited by Norwegian ships engaged in walrus and seal fishing, or in fishing for the "haakjoering" (*Scymnus microcephalus*) on the banks beside the island's coast. The walrus is, however, now but very rarely met with on the western side of Spitzbergen; and its fjords are therefore only occasionally visited for the purpose of taking in water or hunting the reindeer. On how large a scale the hunting of these animals may be carried, is evidenced by the circumstance that the vessels fitted out from Tromsø alone in 1868, according to official returns, killed 996 head. From Hammerfest the returns are still greater; whence one may conclude that, in spite of the war of extermination which, under the name of hunting, has for some time been carried on against these animals, two or three thousand head are annually slaughtered. If we compare that number with the scanty extent of ice-free meadow-land in Spitzbergen, we are tempted to suppose that an immigration must take place from Novaja Zembla, which, nevertheless, is scarcely possible, unless some large island or group of islands facilitate the communication between these two countries, situated at a distance of between 400 and 500 sea miles from one another. Of late years the Norwegians have resumed the method, formerly employed by the Russians,

* The first mountain-limestone petrifications in Spitzbergen were found by Parry in 1827 at Cape Fanshawe, and the same year by Keilhau at South Cape. *Jura* fossils were first discovered by Lovén in 1838; the tertiary plant-remains by Nordenskiöld in the Swedish expedition of 1858; the *Trias* strata by Blomstrand in 1861; the post-tertiary beds, containing *Mytilus*, by Torell, Malmgren and Blomstrand in 1861; the *Saurian* strata by Nordenskiöld in 1864.

of using large nets, formed of rope, to catch the Beluga (*Delphinopterus leucas*); and in 1868 several vessels were fitted out exclusively for that species of fishing. Some of the fishermen whom we met had, on one or two occasions, taken from twelve to twenty head at a single drag of the net: right handsome sport, when one considers that the *Delphinopterus* is often larger than the walrus itself.

Ice-fjord, like most of the other gulfs of Spitzbergen, is surrounded by vast glaciers with their mouths turned towards the sea, which offer to the geologist an opportunity of studying that important phenomenon in the history of the earth's development. But also extensive valleys or declivities free from ice and snow are met with, especially in the inner parts of the fjord, and the fertile soil here produces a vegetation more luxuriant than in other parts of this island group. One may here see whole fields yellow with poppies (*Papaver medicante*), or covered with a thick green and red carpet of the beautiful *Saxifraga oppositifolia*. The fjord, which lies beneath them, and in the summer months is often as still and clear as a looking-glass, abounds with marine animals of various kinds. Everything contributes to make this a most important spot for the study of both animal and vegetable life in the Arctic regions. The zoologists and botanists of this expedition here gathered a rich harvest; among the results of which we may mention the taking of several fine salmon, and fully-developed examples of the esculent mushroom, &c.

We left Ice-fjord on the 13th of August. At the entrance a boat-party was sent out northward, to map and examine geologically Foreland Sound. Their work was now—as during the expedition of 1861, when Blomstrand and Dunér sailed through the sound—rendered difficult by almost perpetual fog. During this time the vessel made a somewhat longer excursion westward for the purpose of making soundings; which, however, were on the occasion rendered almost impossible by the heavy swell. We had arranged to meet at King's Bay, whither both parties came on the 17th, in the afternoon. Several zoological, botanical, and geological excursions having been made from this point, and a large number of miocene fossil plants collected, the *Sofia*, on the 19th, proceeded on her course farther northward.

We had hoped here, in some degree at least, to reinforce our already considerably diminished stock of coal, but we soon found that that would necessarily cause too great a delay. In fact, whereas, more to the south, the tertiary formation occupies the greater part of the extensive peninsula between Ice-fjord and Bell Sound, and there in many places forms mountains of above a thousand feet high,

at King's Bay, on the contrary, its extent is very inconsiderable, so that at present it forms only a few small hills consisting of strongly folded strata, and separated from each other by the furrows cut by the glacier-streams. By this the supplies of coal, notwithstanding the by no means inconsiderable thickness of the beds and their accessibility (they lie only a few hundred feet from the shore of one of the best harbours in Spitzbergen), become of but little value, especially as the frost, which begins at a very short distance under the surface, renders the breaking of them extremely difficult; in fact, in consequence of the ice-drenched coal's extreme toughness, almost impossible without regular mining. It is even to be expected that the whole of what still remains of the miocene formation of this spot will, in a comparatively short period, be washed away.

Late at night, on the 20th August, the *Sofia* anchored at Amsterdam Island, and the following day we had the pleasure of hailing the first of the ships which had been hired in Norway for the expedition for the transport of coals. A coal depôt having been established on the low tongue of land that shoots out south-eastward from Amsterdam Island, and five of the scientific members of the expedition having been, together with necessary tents and boats, landed at Kobbé Bay, to prosecute there their zoological, botanical, and physiological researches, the *Sofia* sailed off with the rest on a sounding-tour towards Greenland. Our intention was to penetrate thither along the 80th degree of N. latitude, but before we had reached the longitude of Greenwich we were met by impassable masses of drift-ice. It was evident that the coast of Greenland was accessible only at a latitude much lower than was compatible with the plan of our voyage. We therefore turned our course north and north-east, and gradually, after innumerable zigzags in the ice, arrived at $81^{\circ} 16'$ N. latitude. The temperature had now sunk to 6° (centigr.), with thick ice, fogs, and snow-storms. The ocean was sometimes covered with a thin coating of new ice, and the old ice northward was quite impassable, so that we were obliged to seek a passage out in a south-easterly direction. After another vain attempt to reach Dépôt Point, in Brandewijne Bay, the *Sofia* anchored, on the 29th, in Liebdé Bay.

During the passage of the *Sofia* from Norway to Spitzbergen, its officers, Captain Baron von Otter and Lieutenant Palander, took a number of soundings in the deeper parts with a "Bulldog" apparatus of the same kind as that constructed at Tromsö, by Torell and Chydenius, for the voyage of 1861, and which was found to be particularly applicable. These soundings were zealously continued during our cruising amid the drift-ice between 80° and 82° , and

gave very interesting results not only as regards the ocean's depth in the parts visited by us, but also concerning Arctic animal life at the greatest measurable depths. It showed us that Spitzbergen may in a manner be looked upon as a continuation of the Scandinavian peninsula, inasmuch as that island-group is not separated from Norway by any very deep channel (not above 300 fathoms), whereas a little to the north and west of Spitzbergen there is a depth of 2000 fathoms and more. From these great depths specimens of clay were brought up by the Bulldog apparatus, which, on immediate and close examination, were found to contain not only several microscopic but even larger and tolerably highly organised animal forms (*e.g.*, several kind of crustacea and annellata). The greatest depth from which any specimen was procured was 2600 fathoms, and the mass there raised consisted for the greatest part of white and red Foraminifera, in general scarcely so large as a pin's head. It is, moreover, deserving of remark, that, during our cruising amidst the ice, we met with and collected, not only a number of pieces of drifting wood, but also (as, for example, at $80^{\circ} 40' E.$) glass balls of the kind used by the Norsemen at their Loffoden fisheries for floats; an additional proof of the already well-established fact * that the Gulf Stream reaches, though in a greatly weakened state, even these tracts.

Liebbe Bay had never before been visited by any scientific expedition, and its topography and geology were accordingly entirely unknown. A boat-party, consisting of Malmgren, Norden-skiöld, and Nyström, with three men, were therefore left here, while the ship went to fetch their comrades who had been left at Kobbe Bay. The boat's journey was favoured by calm and mild weather and a clear sky; although a high wind, accompanied by snow-storms, prevailed out at sea—a circumstance very common at Spitzbergen, and which is said especially to characterise that beautiful and, according to the unanimous testimony of the fishermen, appropriately named fjord. We were thus enabled, during the few days that our boat-voyage lasted, to map it, and ascertain the character of its somewhat uniform geology. Its shores are occupied exclusively by the same red, green, and dark grey kinds of slate, which in Ice-fjord are covered by mountain-limestone strata with *Producti*, and in Mount Hecla form the uppermost stratum of the vast series of schists to which the name of that mountain has been applied. But, as yet, no petrifications had been discovered in these strata. Their age was

* Among the already given proofs of this may be mentioned, that Torell, in 1861, at Shoal Point, met with a bean that had come from the Gulf of Mexico, the *Entada gigantilobium*.

accordingly somewhat doubtful, and the probably Devonian fish-remains which we now found here are therefore a discovery of great value in the explanation of Spitzbergen's geology. The lower slate-beds contained some vegetable remains, though probably of too indistinct a character to admit of identification.

On the 2nd of September, the boat's company and the ship, returning with our comrades from Kobbe Bay, met at a little distance off the promontory that separates Wijde Bay and Liebde Bay. After remaining in that bay a couple of days longer, the *Sofia* weighed anchor and touched at the now ice-free Cape Dépôt, in Brandewijne Bay, in order to fetch away the supply of pemmican that (in 1861) had been left there, an iron boat, &c. We thence steered northward, with the intention of passing round Nordostland to Giles' Land. The greatest part of the arm of the sea that lies between the Seven Islands, Cape Platen, and North Cape, which, in 1861, was already, in the middle of August, perfectly free from ice, we now, in the beginning of September, found covered with a firm crust of ice. It was therefore impossible to reach Giles' Land by this route, and we were therefore obliged, after having, for the purpose of botanical and zoological researches, remained a short time at Castiën's Islands and Parry's Island, which last, being still encompassed by a girdle of land-ice, was approachable only by walking over the ice, to seek another passage, namely, that through Hinloopen Strait. Our course was directed to its southern part.

Already, before the end of September, some signs of the approach of autumn had been visible, and the hill-tops had frequently in the morning been for some time covered with a white mantle of new-fallen snow, which, however, had melted away again without causing any hindrance to our scientific pursuits. But now, during our passage to South Waijgats Islands, a copious fall of snow rendered all further researches in natural history on land impossible, and gave us pretty clearly to understand that the season for our purely scientific pursuits was to be considered as at an end. We accordingly turned back at Mount Lovén, in the southern part of Hinloopen Strait, having first on that spot collected, from under snow of a foot deep, an additional number of mountain-limestone petrifications. On the 12th of September we again anchored at our coal dépôt on Amsterdam Island, and there met our second coal-ship, by which some of the members of the expedition (Fries, Holmgren, Malmgren, Nauckhoff, and Smitt) returned to Norway, carrying with them the valuable collections of objects of natural history which the expedition had up to that time succeeded in acquiring. These collections have now happily arrived in Stockholm, and will, after having been

duly studied, be divided between the National Museum in that city, where already the extraordinarily rich Arctic collections formed by the preceding Swedish expeditions are preserved, and the Museum of Göteborg, the city whose liberal initiative first gave occasion to the new expedition. To give an idea of the extent of these collections, I need only refer to the notices above given of our geological operations, and remark that the zoological sciences were represented by no less than three members of the expedition, who, besides, had with them a taxidermist. Messrs. Malmgren and Smitt had also at their disposal a boat manned with four men for dredging every day, holidays excepted, when the ship lay still. They were thus enabled not only to make a searching examination of the Arctic marine fauna, which, in individual copiousness at least, is comparable with that of many more southern countries, but also to pay due attention to the terrestrial fauna of the locality, more especially the entomological branch, which is poor both with respect to individuals and species, and accordingly presented especial difficulties to its investigator, Mr. Holmgren. The dredgings also yielded rich contributions to the ocean's alga-flora. Every opportunity that offered itself for land-excursions was used by the two botanists of the expedition, both for investigating the flora and for forming a collection of specimens for normal herbaria of Spitzbergen's phanerogamia, mosses, lichens, and algæ.

On the 16th of September we took leave of our homeward-bound companions, and immediately proceeded northward. Our intention was to touch at the Seven Isles, but these were now found to be still more thickly surrounded by ice than when we had visited that tract about a fortnight before. We accordingly determined to avail ourselves of a channel tolerably free from ice, stretching northward from those islands.

After a number of zigzags amidst the drift-ice, our vessel, in longitude $17\frac{1}{2}^{\circ}$ E. from Greenwich, succeeded in arriving at $81^{\circ} 42'$ N. latitude, probably the highest northern latitude a ship has ever yet attained. Northward lay vast ice-masses, it is true as yet broken, but still so closely packed that not even a boat could pass forward, and we were therefore obliged to turn to the south-west and seek for another opening in the ice; but we found, on the contrary, that the limit of the ice stretched itself more and more to the south the more we went to the west, so that, on the 23rd September, in the longitude of Greenwich, we were south of the parallel of 79° N. latitude. On the way we had in several places met with ice black with stones, gravel, and earth, which would seem to indicate the existence of land still further north.

The ice itself had, moreover, a very different appearance from that which we had met in these tracts at the end of August. It consisted now, not only of larger ice-fields, but also of huge ice-blocks, so that it seems as if the former ice had drifted to the south, and given place to new ice-masses coming from the north. The temperature had now sunk to 8° or 9° (centigr.) below the freezing point, and the ice, which in these parts had before been of tolerably loose texture, had now become so compact that any more violent collision with it was combined with no little danger. Furthermore, the nights were now so dark that it was necessary at that time to lay the ship to by the side of some large sheet of ice, at the hazard of finding oneself blocked up there in the morning. Already, in the beginning of September, the surface of the ocean, after a somewhat heavy fall of snow, had shown itself, between the ice-masses, covered with a coating of ice, which, however, was then thin, and scarcely hindered the vessel's progress. Now it was so thick that it was not without difficulty that a way could be forced through it. All things clearly indicated that the season of the year, during which it is possible to sail in these tracts, was nearly at an end, and as we intended to make yet another attempt to find a north passage from the Seven Isles, or seek a harbour for the winter, we determined to return to our coal-dépôt.

On the 25th of September the *Sofia* once more cast anchor at the north-west corner of Spitzbergen, after having slightly struck upon a rock situated under the surface of the water in the middle of South-gat, and which has been forgotten in Buchan and Franklin's admirable chart of that harbour, although it appears, from Beechy's description, that they themselves happened to strike on the same shallow.

After a few days' rest, spent in inspecting the engine and taking in coal (the last remains of our store of coals had to be searched for under a thick covering of snow), and after having placed in the letter-box on the island in Kobbe Bay notices of our journey and our plans for the future, we steamed away again, on the 1st of October, northward, notwithstanding a strong wind and a snow-fog that prevailed in the harbour we left. Our suspicion that this was only local seemed to be confirmed when we got out a little further north, as the weather became clearer and calmer, but at the same time we met already, in lat. $80^{\circ} 40'$, sporadic blocks of drift-ice, which, as we proceeded farther north, increased in number and size. We continued our northward course during the following day, but it was soon evident that no open water would be arrived at that way, and in the afternoon we were again steering in a southerly

direction. During the night we lay to under cover of a large sheet of ice. The temperature had now sunk to $14^{\circ} 5'$ (centigr.), so that in calm weather the surface of the water between the ice-masses was covered with ice of two or three inches' thickness, which considerably impeded the progress of the ship. But the following day we stood southward till we got into something like open water, and then followed the edge of the ice in a northerly and north-westerly direction. By this means we again arrived at 81° N. lat., but here the *Sofia* met with a misfortune, which put an end to all further efforts to proceed northward. In the morning of the 4th of October, during a storm from the south-east, and with a high sea, the ship was thrown violently upon a huge ice-block, or rather a small iceberg, whereby she sprang an extensive leak. We were therefore forced to turn back immediately and seek our harbour, where we arrived late in the evening, after eleven hours of incessant labour to keep the vessel free from water. Nevertheless, though all took part in this work, the water continually rose, so that, when the anchor was cast at Amsterdam Island, it stood about 2 ft. over the cabin floor. Fortunately the provisions, being kept between water-tight bulk-heads, were uninjured, and we succeeded, though with great difficulty, in keeping the engine-room so free from water that the fires were not extinguished. Had this not been the case, our ship must unquestionably, in a short time, have been the prey of the storm and the extremely heavy sea, which now, contrary to our former experience, raged among the thinly scattered fields of drift-ice. Immediately on our arrival at Amsterdam Island the ship was careened and the leak provisionally stopped, so that already the next day we were in a condition to seek a more secure harbour in King's Bay. Here the ship was hauled so close to land at flood, that we, at ebb, were enabled to come at the leak and stop it effectually.

King's Bay, which in summer time is almost free from ice, was now filled with innumerable ice-blocks fallen from the mighty glaciers of the fjord, which, when carried by the flood-tide in towards land, totally barricaded the harbour in which the *Sofia* had taken refuge; and, notwithstanding that the temperature here was considerably higher than in the neighbourhood of 81° N. lat., these blocks froze during the calm weather so fast together, that when we, on the 12th of October, were again in a condition to sail, it was only with the utmost difficulty that our vessel could get out.

Our stay in King's Bay, like all the preceding occasions on which the ship remained any length of time still, was taken advantage of by our Natural Philosopher, Dr. Lemström, for the purpose of making

observations for the determination of the magnetic constants and variations. The ground was, however, too deeply covered with snow to allow of any geological or botanical operations. Even the brooks, so copiously supplied with water in the summer time, which intersect the lowlands adjoining the coal harbour, were now so entirely dried up by the effect of the cold that we endeavoured in vain to reinforce our now considerably reduced supply of water.

Our ship, which had had two ribs broken by the blow that caused the leak, was now too weak to be exposed, with the slightest prospect of success, in any new attempt to force a way through fields of drift-ice, as would in all probability be necessary, should we endeavour to visit the Seven Islands, which place we had intended to make our winter harbour; and the wintering in any other part of Spitzbergen not having either entered into the plan of our voyage, nor promising any results commensurable with the costs, dangers, and hardships of passing the winter there, we determined to return to Norway. But yet we wished to make an attempt to reach Giles' Land round the southern point of Spitzbergen, which was probably still free from ice. Already during our passage along the west coast of Spitzbergen, which in summer is entirely free from ice, we passed large though scattered fields of ice, which farther to the east, near the Thousand Isles, completely obstructed the way. We were, therefore, constrained to relinquish that plan also, and to direct our course towards Norway. After having been once more, on the shallow banks off Beeren Island, during a severe storm and in a high sea rendered to the last degree boisterous by the shallowness of the water, in great danger of being ice-beset, the *Sofia* anchored again on the 20th of October in Tromsø Harbour, where we had the pleasure of learning that our comrades had happily arrived and reached home in safety.

From the above it appears that the expedition, as regards its second object—namely, hydrographical investigations in the Polar Basin—did not succeed in reaching any remarkably high degree of latitude; so that the compass of the portion of our globe that is known to us, has not been to any material amount increased by it. I hope, however, that it has afforded a by no means unimportant contribution to the solution of the so-called Polar question.

A lively controversy has, as is generally known, been of late years carried on between the principal geographical authorities concerning the real character of the Polar Basin, some geographers maintaining that it is covered by an unbroken surface of ice, presenting an impassable barrier to the progress of a ship; while

others look upon this as only an obsolete prejudice, arising in a great measure from exaggerated descriptions of the difficulties which the sailor encountered at the point where he turned back. That this latter view, at least as regards that portion of the Polar Basin that borders on Europe during the actual sailing-season in the Northern Seas, *i. e.* the summer, is not in conformity with the real fact, has been proved, not only by the adventurous journeys of the older Arctic travellers, but by a number of expeditions sent out during the last century for the exclusive purpose of such investigations, among which may be mentioned :—

Tschitschagaff's 1st expedition, 1765, which with their ship could only reach		80° 21' N. lat.	
„	2nd	„	1766, which reached 80 28 „
Phipps'	„	„	1773, „ 80 37 „
Buchan and Franklin's	„	„	1818, „ 80 34 „
Scoresby's	„	„	1806, „ 81 30 „
Sabine and Clavering's	„	„	1823, „ 80 20 „
Parry's	„	„	1827, „ 81 6 * „
Torell's	„	„	1861, „ about 80 30 † „

It might then have been considered as already absolutely decided that it was not possible at that season of the year to penetrate very far into the Polar Basin, and any repetition *at the above-named season of the year* of these attempts could therefore only be looked upon as continually treading in old footsteps, which demonstrably do not lead to the intended object. But one doubt remained. At the season of the year when, in consequence of the heat of the summer and the influence of the ocean-waves and ocean-streams, the ice-masses have been reduced to their minimum—that is to say, in the autumn, before the formation of the new ice, no ship had ever before visited the Polar Basin. One could with certainty foresee that it might then be possible to go farther than in summer. There was a possibility that one might at that season be able to penetrate very far, perhaps to some land lying north of Spitzbergen, which might hereafter serve as base from whence to push still farther onward. These considerations constituted the ground for the plan of operations for the latter portion of the Swedish expedition, and it may now be considered as proved.

That one may, during autumn, reach by ship a latitude considerably higher than that which has been attained by most of the summer expeditions, unless this year is to be considered as unusually

* By ship, but on the ice the party penetrated to 82° 45'.

† By ship, but in boats and by land journeys as far as 80° 45'.

unfavourable with regard to the condition of the ice, we might in all probability have proceeded a considerable distance farther, perhaps beyond 83° N. lat. But we have at the same time convinced ourselves that, even in autumn, further progress is soon rendered impossible by impenetrable masses of broken ice. The voyage itself, moreover, at that season of the year, in consequence of the cold, the darkness, and the boisterous winds, accompanied by snow-storms that at that time of the year are prevalent in the Polar Basin, and the heavy sea amidst the masses of drift-ice caused by these latter, is rendered so dangerous that the risk to which the traveller exposes himself is far from being compensated by the meagre prospect of success. The idea itself of an open Polar Sea is evidently a mere hypothesis, destitute of all foundation in the experience which has already by very considerable sacrifices been gained; and the only way to approach the Pole, which can be attempted with any probability of succeeding, is that proposed by the most celebrated Arctic authorities of England, viz., that of—after having passed the winter at the Seven Islands, or at Smith Sound—continuing the journey towards the North on sledges in the spring.

The paper will be published entire, with a map, in the 'Journal,' vol. xxxix.

The PRESIDENT, in expressing the thanks of the Society to Mr. Nordenskiöld and M. von Otter for their valuable communication, said that it was a straightforward account of the proceedings of the party in those regions. The nautical part of the paper must be particularly interesting to the many distinguished naval officers present. He hoped some of them would express their opinions as to the value of the definite conclusions which the author of the paper had arrived at. He was sorry that Dr. Petermann, to whom the Society awarded their gold medal last year, and who had urged Germany to send out a small squadron to reach the Pole by the supposed open Polar Sea, was not present to advocate his views. The observation of great floating masses of ice, bearing stones and clay, drifting from the north, certainly indicated that it was not all open sea, but that there must be land in that quarter. He should be happy to hear the opinion of Arctic officers on that point, and he would first call upon Sir George Back, one of their Vice-Presidents, who had so much distinguished himself in such researches, to address the meeting.

Admiral Sir GEORGE BACK said the failure of these ships to make the passage, or even to get to any distance to the eastward of Spitzbergen, was a significant fact, because that passage had been advocated by very able Polar officers. Two of those used on a former expedition were sailing-vessels; but the *Sofia* was a steam-vessel, fitted out efficiently for the purpose, and aided by two transports laden with coal, which was deposited at Amsterdam Island. The *Sofia* tried to get to the north, and, failing to do so, did precisely what the *Dorothea* and *Trent* did in 1818, follow the trend of the ice westward, with the view of sighting Greenland, if possible. In this she was baffled, as the former expedition had been; then, going in a zigzag direction to the north, she attained to latitude 81° 16', and after great efforts succeeded in

attaining to latitude $81^{\circ} 42''$, which the Swedes, with very pardonable pride, considered was the highest degree of latitude ever reached by a ship. Scoresby, however, whose object was not scientific investigation, but the capture of whales, attained in a most favourable season to 82° . There was another resemblance between the Swedish expedition and the expedition of 1818. The *Sofia* got thrown upon a heavy mass of ice and was seriously injured, and had it not been for the power of steam, she might have been lost; but her steam enabled her to go to Amsterdam Island, and subsequently to Smerenberg Harbour, where she was repaired. It was to that very place the *Dorothea* and the *Trent* went in 1818—the *Dorothea* to be hove down to repair damages brought about by having been crushed in “taking the pack” during a furious gale. Well, these gallant Swedes, nothing daunted by all those serious circumstances, tried again and again; but the ice became thicker and more compact, and they were less able to advance against it. Ultimately, late in October, they bore up for their own country, and arrived at Tromsø on the 20th of October—the very same thing which the *Dorothea* and *Trent* did, and at the same period of the year, just half a century ago. The parallel showed how very little the circumstances of Polar navigation were altered in the direction of Spitzbergen. He was not going to give an opinion whether the route by Smith Sound, by Nova Zembla, or Spitzbergen, or by that between Spitzbergen and Greenland, was the best to attempt. It seemed to him that it was only by a repetition of small expeditions that the approach to the Pole might be successfully made, namely, by being on the spot when Nature, in some of her favourable moods, might open out the ice and leave a passage clear for an adventurous explorer. He could not sit down without expressing his unqualified admiration of the perseverance and steadiness which characterised the Swedish expedition.

Admiral OMMANNEY said he could not extol too much the courage which animated the Swedes in carrying out this expedition. But he should like to have heard something more about the construction of the *Sofia*. He had heard that she was constructed of iron. Success in penetrating the Polar sea depended a great deal upon the way in which the vessel was constructed. If the *Sofia* had been of more substantial construction she would not have succumbed to the first blow of the ice, as she appears to have done. The masses of ice met with, covered with stones and earth, was to him a hopeful indication of our being able to reach the North Pole by way of Spitzbergen, of which he had always been an advocate. He hoped the failure of the present expedition would not discourage those who were in favour of that route. He was happy to see that the point reached by Parry still stood far to the north, and he hoped it would never be surpassed by any other country but England.

Staff-Commander DAVIS was of opinion that the most important part of the communication just read was the fact of masses of ice being seen bearing stones and earth; but Professor Nordenskiöld had omitted a singular fact, also observed by the same expedition, and which was recorded in Petermann's ‘Mittheilungen,’ viz., that in the spring of the year large flocks of birds take flight, going due north from the northern parts of Spitzbergen. This, taken in conjunction with the first-named circumstance, would lead to the belief that land existed to the north.

Admiral Sir EDWARD BELCHER said from what he had heard in this paper, and from what he had collected from Parry and Sir James Ross, he believed the ice which came down, always southerly, on the western side of Spitzbergen, and in such quantities, must cause a vacuum to the northward; and in that vacant space he felt perfectly satisfied vessels might winter, as, for instance, on the north-west of Spitzbergen, and in one of these open seasons find their way to the north. Parry, in his last observations in 1827, after having tried

all these points in the Arctic Sea, pointed out that there was a general pressure from the eastward to the westward. That we know to be the case. In Davis Straits the sea on the eastern side was open, and from an easily understood cause. All the slopes on the western coast of Greenland lay to the sun; the sun never had altitude sufficient to look on the eastern coast, consequently there were no thaws of any importance on that side, nothing to liberate the land-floe and enable it to leave the shore. On the western shore of Spitzbergen, the same rule held; the sun could only play upon that side and liberate the ice there. But if an expedition had to start again, he should advise that Nova Zembla should be the point of departure, and that the expedition should endeavour to pass westerly of that island and tumble down, if possible, on to the west of Spitzbergen on the homeward voyage. From what he could collect from the paper, the Swedes were about to try another expedition. He believed what Swedes could do Englishmen could do.

Captain Sir LEOPOLD M'CLINTOCK thought these scientific and gallant Swedes had summarised very completely the experience of a great number of previous Arctic expeditions which had visited the same seas. The Swedes seemed to have reached within half a degree or so of the extreme northern latitude attained by English explorers; they had met with similar reverses, and they had returned with much the same story to tell. There was one circumstance to be observed. All the ice they had met with was broken-up ice. It was clear they had not arrived at a fixed unbroken barrier of ice, such as impeded the progress of Ross in the south. With a sufficiently strong vessel and powerful steam-machinery they might succeed in penetrating another 100 miles farther to the north—to 83° or 84°—but there they would, he thought, meet with an impenetrable barrier. He was not a believer in an open Polar basin. According to all our experience of temperature in modern Arctic expeditions, we found the farther we went north the colder was the mean annual temperature. There were no indications of approaching a milder climate, as some theorists suggested; we found less animal and vegetable life, and we got far beyond where the Esquimaux could live.

Admiral Sir EDWARD BELCHER quoted from Parry's work the temperatures of the air and sea taken on the expedition in which Sir George Back took part in 1818. There was a whole series of observations given, and they went to prove that the difference in the mean temperature of the air and sea between the Orkneys and Cape Farewell was not so great as we imagined.* He saw

* The journals of Franklin, 1818, Ross in 1818, Parry, 1827, and that of James Ross in Cove, 1837, prove that the sea does not attain a very low temperature as late as September; and that on the chord between the Orkneys and Cape Farewell, the south point of Greenland, in January, February and March, the temperatures are even higher than in summer. Thus:—

Extract from Admiralty Official Journal of Lieut. Franklin—hired ship Trent.

				Air. °	Sea. °	
<i>Trent</i> on May 30	79° 46' N.	13° 40' E.		31° 0'	30° 0'	
„ 1 June	80° 30'	8° 22'		24° 0'	29° 0'	
Beset in ice up to 12th ..	79° 50'	11° 0'		30° 5'	30° 5'	
Range.—Air .. 26 to	35° 5'					
Sea .. 29 „	36° 0'					
June 22nd	80° 0'	10° 12'		32° 0'	30° 5'	
July 10	80° 22'	10° 37'		49° 0'	32 surface, 36 at 119	Fathoms.
All August.—Mean air ..	34° 7'	Sea ..	36° 7'			
Min. air ..	30° 0'	Max. ..	41° 0'			
Min. sea ..	35° 0'	„ ..	39° 0'			

nothing to give us cause to fear from cold weather, or to prevent the use of a steamer; and if the turbine were used, he was perfectly satisfied the action of the turbine would throw off the ice from the sides of the vessel, and enable her to proceed much more safely than she could do with the screw or paddle.

Admiral Sir GEORGE BACK said the temperatures quoted by Sir Edward Belcher were, he believed, perfectly correct; he could not speak to them himself from memory. But he recollected this fact, and he had good reason to recollect it. It was his duty to take the sun's altitude at midnight, when the sea was invariably frozen on the shady side of the vessel, merely forming a very thin film of ice. On the other side of the vessel it was comparatively warm, and there was a thaw. Sir Leopold M'Clintock spoke of the large blocks of ice; but in 1818 there were unbroken floes of ice four or five miles in diameter,—the floes remained almost stationary for some time, and the ships were made fast alongside. At length they got a circular motion and opened a space wide enough to pass through, and if they had possessed steamers, instead of heavy old colliers, he did not know where they might have gone to.

Admiral COLLINSON said the observations made by the gentlemen who had gone out on this expedition entirely corroborated the views which he expressed before the Society some time ago with respect to the possibility of reaching the Pole. The question was raised whether they should go by Smith Sound

				Air. °	Sea. °
September 18	70° 0' N.	0° 41' W.	40° 5'	45° 0'	
Off Faro Island.					
„ 30	62° 19'	7° 34'	50° 0'	49° 0'	
Sir John Ross anchored, Brassa Sound, 1st Nov. 1818			49° 0'	51° 0'	
Longitude.					
Parry, July 4 to 11, 1827	81° 40'	22° 54'	32° 0'	32° 5'	30 = 400 fath.
and 22nd	82° 11'	24° 23'			
	82° 43'	19° 54'	31° 0'	34° 5'	
Sea.					
A.M. P.M.					
Cove, James Ross	59° 07'	6° 20'	49° 0'	48° 0'	
12 January, 1836	60° 25'	11° 30'	47° 0'	46° 0'	
	61° 02'	23° 20'	47° 0'	47° 0'	
	59° 34'	30° 13'	47° 0'	45° 0'	
25 February	59° 29'	7° 24'	47° 0'	48° 0'	
	59° 10'	16° 0'	47° 0'	48° 0'	
	59° 0'	20° 5'	47° 0'	48° 0'	
20 March	56° 25'	33° 1'	44° 0'	44° 0'	
31 „	54° 42'	41° 0'	39° 5'	39° 5'	

Sounded,—27 fathoms, 44° 5'; surface, 39° 5'; air, 34°.

Franklin in conclusion remarks:—

				Degrees.		
Temperature of air between {	General state	..	47	46	45	
60° and 70° N.	One fine calm day	..	50	52		
During foggy weather .. ..	.. .. .	..	44	42	39	36
Water .. ..	.. .. .	..	47	46	45	
Decreasing gradually between 60° and 70° to	.. .. .	..	37			
Air between 70° and Cherry Island .. ..	.. .. .	..	33	32	31	
°						
Dane's Island Observatory .. ..	.. .. .	..	79	40	20 N.	
11 6 15 E.						

The approach to ice was not at all indicated by *any change*; nor do I think from the temperature, either of water or air, that we could have judged of our proximity to Cherry Island and the surrounding sea when we made it, had not the reckoning informed us.

or by Spitzbergen. He then stated that Parry's experience was, that unless you got hold of the land it was useless dealing with an ice-pack; there was no prospect of getting forward at all. Directly you thrust yourself into the pack, you had to go just where the pack chose to take you. Therefore, the only way to get forward in the Arctic regions was to hold by the shore. The observations of these Swedish officers entirely corroborated that view. The most interesting feature contained in the paper was, that masses of ice combined with stones had been found. As far as he could comprehend, these masses of ice and stone had been found to the westward and southward of the north point of Spitzbergen, and he would suggest that it was from there they came. He would expressly call attention to this particular fact, that Parry, when he proceeded to his most northerly point, saw nothing of stones. He had to drag his boats over the ice, and not a particle of stone was found there, not one iceberg was seen. Now, the indications of land to the north would be shown by icebergs: if there was land and open water, there would be icebergs. There was not an iceberg to be seen to the north of Spitzbergen, and from this he contended there was no proof of land to the northward of that point; and if there should be land, our only chance was to get hold of it and coast along. He made these observations in consequence of having traced the pack along Behring's Straits, and seen how impracticable it was to deal with ice in floating masses of that kind.

The PRESIDENT wished some of the naval officers present would tell the meeting what they thought could be accomplished by steam-power in the Arctic seas.

Captain INGLEFIELD, R.N., said he had commanded three vessels in the Arctic regions with steam. There was no doubt steam was of the greatest assistance in getting through ice. Upon several occasions they were enabled to break through ice upwards of 14 feet in thickness; by charging it on several occasions they succeeded in making a crack and in pushing the ship through. With reference to the question of reaching the Pole, he confessed he inclined very much to the route by Spitzbergen, for two reasons. In the first place, while making one voyage to Smith Sound, it was possible to make two or three attempts to reach the Pole by Spitzbergen. The other day, when Captain Sherard Osborn read a paper before the Society, advocating the route by Smith Sound, he was called upon to make some remarks; but he thought it would better serve the interests of the Arctic expedition to abstain from doing so, because he was in favour of the Spitzbergen route; and the Chairman had stated that one of the objections raised by Government to sending out another expedition was that Arctic officers were divided in their opinions as to which was the best route. Nevertheless, he advanced this as one of the reasons for the *route* by Spitzbergen, that we might make several attempts while we were making one attempt by Smith Sound. He had made one attempt by Smith Sound, and he was sure he should have had a better chance by Spitzbergen. He believed there was an open polar sea, from the fact that there was a strong current setting out of it; and that he had found the trunk of a tree upwards of 20 feet long at the top of Wellington Channel, which must have drifted across that sea.

Admiral Sir EDWARD BELCHER said the mode by which stones got into the ice was simply this, that the land-floe attached itself to the gravelly beach, and as the tide rose and fell towards the spring, the ice falling at an inclination broke at last, and the floe carried away with it the gravel that had been attached to it. It was very well known that the 25 feet and 40 feet floe-ice was composed of layers of 8-feet floes piled one above the other.

The PRESIDENT in concluding the discussion said, he much regretted that we were not likely to have the great question of the geography of the North Polar Basin determined by an expedition sent out by the British Government,

but he did not despair of seeing some spirited individual take it up and carry out those researches which the Government had declined to do, chiefly for the reason that Arctic officers differed among themselves as to the route which ought to be taken.

2.—*Notes on a Journey from Ningpo to Shanghai.* By

CHR. T. GARDNER, H.B.M. Consular Service, China.

THE author stated that having been for nearly eight years in the service of her Majesty's Government in China, and had opportunities of travelling in various provinces of China, he did himself the honour of giving the Society an account of a journey he made in the province of Chékiang, in which he was interpreter and consular assistant during the past two years. The paper contained, more particularly, a description of a journey from Ningpo to Hangchow.

On the 1st June, 1868, his party—consisting of Mons. Eug. Simon, of the Society of Agriculture, Paris, and French Consul at Ningpo; General Cooke, in the service of the Chinese Government; Mons. Novion, in Chinese Government service—started from Ningpo on their journey to Shanghai, *via* Hangchow, in a yacht of about 50 tons' burden, belonging to Cooke. The yacht was built *lorcha* fashion, *i. e.*, a sort of combination of the modern European sailing-vessel and Chinese junk. Like all Chinese boats it was propelled, in the absence of wind, by the rotatory movement of a scull on a pivot at the stern of the boat, acting on the screw principle. The party went up the Yu Yao branch of the Yung River, as far as a town called Yu Yao, which lies on both sides of the river, and is about 40 miles from Ningpo. This voyage had been so frequently made by our gunboats, and observations as to the River Yung are so well recorded, that it was unnecessary to dwell on this part of the journey, except to mention that halfway to Yu Yao from Ningpo, on the right bank of the river, great stone-quarries exist, probably the greatest stone-quarries in China; over 1500 feet in altitude of sheer stone-mountain have been cut entirely away, caverns excavated in some places to 30 or 40 feet below water-level, and many wells of almost unfathomable depth discovered; when it is considered that all this has been done with the rudest implements, no saw ever being used, we may obtain some idea of what human industry and patience can effect, even with the smallest means. On the left bank of the river, some 3 to 4 miles inland, is the small but pretty town of Tzu-chi, in which were formerly the country residences of the rich native gentry of the larger towns. These houses had originally pretty ornamental gardens and rockeries attached to them; all of these, however, were completely destroyed by the Taiping rebels, and the